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(54) Electronic still camera having automatic orientation sensing and image correction

Elektronische Stehbildkamera mit automatischem Orientierungssensor und Bildkorrektur

Caméra électronique à image fixe comprenant un capteur d'orientation automatique et une connexion d'image

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Description

FIELD OF THE INVENTION

[0001] This invention pertains to the field of electronic still imaging and, more specifically, to a hand-held electronic still camera capable of being held in various orientations relative to a subject.

BACKGROUND OF THE INVENTION

[0002] In conventional video cameras (such as 8mm camcorders), which display an image on a television screen, the camera must be held in the normal horizontal (or "landscape") orientation to obtain a properly oriented image. If the camera is rotated to a vertical (or "portrait") orientation, the displayed television image will likewise be rotated, unless the display screen or viewer are rotated, which is impractical in most television applications. This situation is even more of a problem in practice because there are actually two "portrait" orientations, one for clockwise rotation and the other for counterclockwise rotation. The result is shown in Figure 1, where for the two "portrait" orientations, the sky appears at the left or right of the screen, rather than at the top. In conventional film-based photography, the film camera may be rotated to any orientation. When vertical "portrait" camera orientations are used to take pictures, the resulting prints are simply rotated when viewed or, alternatively, slides are simply rotated in the viewing projector.

[0003] Recent electronic still cameras, such as the Kodak DC 40 camera (sold by Eastman Kodak Co.), allow the user to take still images and display them on a computer screen. Like film cameras, these electronic cameras can be easily rotated so that the image can be composed in either the horizontal "landscape" orientation, or either of the two vertical "portrait" orientations. However, the images initially displayed on the computer screen always assume that the camera was held in the horizontal position. As a result, any pictures taken with the camera in the "portrait" orientations will be rotated so that the sky (upper part of the picture) is at the left or right, rather than at the top. Some computer image processing software, such as Adobe Photoshop™ (sold by Adobe Corp.), allows images stored in a computer to be rotated to their proper orientation. However, this is a "manual", time-consuming step, which requires the user to select each and every "portrait" orientation image and perform the proper clockwise or counterclockwise rotation.

[0004] Automatic reorientation in a special "album" application is shown in U.S. Patent No. 5,274,418, as follows. A still video camera captures a plurality of pictures with control information for assembling the pictures into album-like pages. The camera includes an orientation detector that marks the output medium as to orientation. A separate player reads the orientation data and adjusts the images as necessary for proper placement on an album-like page display. This imaging system requires special application programs in the player, which means the orientation correction is dependent upon use with that specific player. As a result, the reorientation is "automatic" only if used with the special application programs in the special player.

[0005] JP-A-01130675 describes an electronic camera having means for detecting the orientation of the camera and means for recording the orientation information for every photographed pictures at the time of recording ; said stored orientation information being used to control the longitudinal and horizontal positions of a monitor screen at the time of reproducing.

[0006] JP-A-2,278,973 describes a digital camera provided with a horizontal/vertical position detector in order to convert the vertical direction of the still image to the horizontal direction whereby each image present the same orientation. However, said document does not recognize the fact that two vertical orientations are posible (clockwise and counterclockwise rotation) and that, during conversion, rows of data are lost.

[0007] Another type of picture processing corrects for unwanted tilting of the camera. As shown in U.S. Patent No. 5,227,889, a video camera detects, and corrects for, the amount of slant of the entire camera in the vertical direction, due to inclination of the video camera while, e.g., walking. The slant is corrected by controlling the addressing of two field memories, depending on the slant information, thereby delivering an output signal that is corrected for slant of the output moving picture signals in real time. As a result, unwanted camera orientations are corrected in the output signal. While correcting for accidental slant of a motion video camera may make good sense, a still camera is frequently maneuvered so as to purposefully take a slanted picture, e.g., to include all desired picture detail in the still picture. A continuous slant correction would defeat this capability. The problem, in other words, is not with the handling of unwanted situations such as picture slant, but with the handling of desired situations, such as "portrait" orientations, and the provision of appropriate corrections for those situations.

SUMMARY OF THE INVENTION

[0008] The problems heretofore described appear in an electronic still photographic system such as described in claim 1 and comprising a removable memory which can be connected to a camera which can be positioned in a variety of orientations relative to a subject, including a vertical "portrait" orientation and a horizontal "landscape" orientation. In solving these problems according to the teaching of the invention, the camera is provided with an electronic image sensor for generating an image signal corresponding to a still image of the subject and an orientation determination section for sensing the orientation of the camera relative to the sub-

ject. The orientation determination section provides an orientation signal indicating at least the vertical orientation of the camera relative to the subject. An image processor in the camera is responsive to the orientation signal for processing the image signal and correcting the orientation thereof so that the still image is output from the camera and stored in the removable memory in a predetermined orientation.

[0009] The invention is summarized as follows.

[0010] The present invention provides an electronic still camera which can be positioned in a variety of orientations relative to a subject, including a vertical "portrait" orientation and a horizontal "landscape" orientation, said camera comprising:

an electronic image sensor for generating an image signal corresponding to a still image of the subject;
an orientation determination section for sensing the orientation of the camera relative to the subject and for providing an orientation signal indicating at least the vertical orientation of the camera relative to the subject; and
an image processor responsive to the orientation signal for processing the image signal and correcting the orientation thereof so that the still image is output from the image processor in a predetermined orientation.

[0011] Preferably, the orientation determination section provides indication of the horizontal orientation of the camera relative to the subject as well as the vertical orientation, and may include an orientation sensor responsive to the vertical and horizontal orientations of the camera. The orientation sensor may include at least one mercury switch.

[0012] The orientation determination section may include a logic section responsive to the orientation sensor for producing an orientation code having several values indicative of the several orientations.

[0013] The image processor may include a buffer memory for storing the image signal and a memory controller for addressing the buffer memory whereby the addresses are varied between read and write cycles such that the memory is read in a different order than it is written for non-horizontal orientations and the image is always output from the image processor in the predetermined orientation. Preferably the predetermined orientation is the horizontal orientation.

[0014] The invention further provides a method according to claim 9 for rotating images stored in a removable memory connected to a hand held camera which can be operated in a variety of orientations, including a horizontal "landscape" orientation, and two vertical "portrait" orientations, one for clockwise rotation and the other for counterclockwise rotation, said method comprising the steps of:

sensing the orientation of the camera relative to a subject;
providing a code signal indicating the camera orientation;
generating an image signal corresponding to a still image of the subject;
associating the image signal with its corresponding code signal;
processing the image signal in response to the code signal to correct the orientation thereof and provide a processed image signal that is output in a predetermined orientation; and
storing the image signal in a memory for subsequent access by a display device, whereby the still image will always be displayed in the predetermined orientation.

[0015] More specifically, the electronic still camera includes orientation sensors, such as a pair of mercury switches, which determine whether the user is holding the camera in the normal horizontal "landscape" orientation when taking a picture, or in a vertical "portrait" orientation. The image is rotated in the camera and always stored in the same orientation (i.e., horizontal).

ADVANTAGEOUS EFFECT OF THE INVENTION

[0016] Since the image is rotated in the camera, so that the stored image always has the proper orientation, a main advantage of the invention is that the image is then correctly displayed on the screen of a player/computer without need for a special application program.

[0017] These and other aspects, objects, features and advantages of the present invention will be more clearly understood and appreciated from a review of the following detailed description of the preferred embodiments and appended claims, and by reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

Figure 1 is an illustration of the situation in the prior art, wherein vertical "portrait" pictures are shown incorrectly oriented on a display screen;
Figure 2 is a block diagram of an imaging system, including an electronic still camera having orientation correction according to the invention;
Figure 3 is a flow diagram showing the operation of the camera according to the invention;
Figure 4 shows the stored images in proper orientation according to the invention;
Figure 5 is a flow diagram showing an alternative operation of the camera;
Figure 6 shows the stored images according to the alternative operation shown in Figure 5;
Figure 7 shows an embodiment of orientation sensors used in the camera shown in Figure 2;

Figure 8 shows an embodiment of signal processing architecture for obtaining image rotation; and
Figure 9 is an illustration of how the architecture of Figure 8 is employed to read a buffer memory for the various orientations.

DETAILED DESCRIPTION OF THE INVENTION

[0019] A block diagram of an electronic camera 10 using automatic orientation correction according to the invention is shown in Figure 2. The camera is ordinarily a hand-held unit including a lens 12 for focusing an image of a subject 14 on a charge-coupled device (CCD) image sensor 16. The sensor 16 is clocked by a CCD driver circuit 18 to produce an analog image signal corresponding to a still image of the subject, and the image signal is converted to a digital image signal by an analog-to-digital (A/D) converter 20. The exposure time is controlled by a conventional diaphragm 23, which regulates the aperture of the lens 12, and by conventional electronic shuttering of the image sensor 16 by use of the CCD driver circuit 18. (Alternatively, a mechanical shutter (not shown) can be used.) The digital image signal is processed by an image processor 22 and stored in a digital memory, such as a removable solid-state memory card 24, which has memory for storing a plurality of processed digital images. The CCD image sensor 16 may be a Kodak model KAF-0400C CCD sensor, which has 512 lines of photoelements, with 768 photoelements per line. Since the spacing between photoelements is 9 microns in both the vertical and horizontal directions, the KAF-0400C sensor has "square" pixels and a 3:2 horizontal aspect ratio.

[0020] The memory card 24 is preferably configured according to the well-known PCMCIA card interface standard described in the PC Card Standard, Release 2.0, published by the Personal Computer Memory Card International Association, Sunnyvale, California, September, 1991. The standard prescribes interface pin assignments for coupling the memory card 24 to the camera 10 through a PCMCIA interface 26, from which it can be removed from the camera 10. Once removed, the card 24 may be inserted into a computer 28 through a similar PCMCIA interface 30. A central processor 32 in the computer 28 reads the image signal from the memory card 26 and provides the image signal to a display 34, so that the images can be displayed on the computer system. Alternatively, a solid-state memory corresponding to the memory card 24 can be fixed inside the camera, and the camera itself can be "tethered" to the computer by an interface cable (not shown) so that the images can be downloaded and displayed. In either case, the images are displayed in the correct orientation for proper viewing.

[0021] As an aspect of the invention, the camera includes an orientation determination section 36, which determines whether the camera is in the horizontal "landscape" orientation, or the first (clockwise) or second (counterclockwise) vertical "portrait" orientations. (As described later in connection with Figure 9, the orientation determination section 36 could also determine when the camera is being held upside down in an inverted horizontal position.) The orientation determination section 36 includes one or more orientation sensors 40 and a logic section 42 that produces an orientation signal indicating the orientation of the camera relative to the subject. The orientation signal is applied to a camera control interface 38. The orientation signal indicates at least the vertical orientation of the camera (the absence thereof, in that case, indicating a horizontal orientation), or, alternatively, the orientation signal may provide positive indication of either the vertical or the horizontal orientation of the camera. When signaled by a shutter button 44, the camera control interface 38 instructs the CCD driver circuit 18 to begin clocking an image signal from the sensor 16. At the same time, the interface 38 applies the orientation signal from the orientation determination section 36 to the image processor 22. The image processor 22 is responsive to the orientation signal for processing the image signal and correcting the orientation thereof so that the still image is output from the image processor 22 in a predetermined orientation for storage in the memory card 24, and subsequent imaging on the display 34. Ordinarily, the predetermined orientation is the same for all images, and the image processor 22 converts the vertically oriented images into horizontally oriented images. Note that for landscape orientation, the image is 512(V) x 768(H), but for the two portrait orientations, the stored image is 768(V) x 512(H).

[0022] Figure 8 diagrammatically illustrates a signal processing architecture for obtaining image rotation, which may be incorporated in the image processor 22, either as hardware or software. Data read from the A/D converter 20 is coupled over an input bus 50 to a random access buffer memory (RAM) 52, which has storage capacity corresponding to at least one image (512 by 768 pixels). The orientation signal is coupled over a control bus 54 to a memory read out controller 56. The memory read out controller 56 may be a programmed part of a controller microprocessor 57 in the image processor 22, or it may be separate dedicated combinational logic driven by the microprocessor 57 for controlling the generation of read out address/clock signals for the memory 52. The address/clock signals are supplied over respective address bus links 58 and 60 to a set of associated row and column address counters 62 and 64, respectively, for controlling the rate and order in which the contents of the memory 52 are accessed. In particular, the clock signal lines allow counters 62 and 64 to be incremented (when the up/down signal is asserted) or decremented (when the up/down signal is not asserted). A similar signal processing architecture, which makes automatic use of orientation codes, is shown in U.S. Patent No. 5,270,831, "Storage and Playback of Digitized Images in Digital Database Together with Presentation Control File to Define Image Orientation/Aspect Ratio",

which is incorporated herein by reference.

[0023] The memory controller 56 effects reorientation of the image in the memory 52 by controlling readout of the pixel raster as shown in Figure 9. A memory write map 66 shows the data as taken directly from the sensor 16 without regard to orientation. If the camera is horizontal, a horizontal read map 68 will be the same as the memory write map 66. However, if the camera is held in a clockwise vertical or counterclockwise vertical orientation, the memory controller 56 will begin reading the memory 52 from the bottom left or the top right, respectively, as shown in a vertical (clockwise) memory read map 70 and a vertical (counter clockwise) memory read map 72. Figure 9 also shows the case of an inverted horizontal image, that is, an image obtained when the camera 10 is held horizontal but upside down. In this case an inverted memory read map 74 is just the inversion of the horizontal memory read map 68. (Since the latter condition is more of an accident than intentional, the camera 10 may feature a lockout or a warning mechanism (not shown), when the camera is held upside down.)

[0024] An embodiment of the orientation sensor 40 is shown in Figure 7. Two mercury filled switches 82, 84 are mounted in the camera 10, one in a vertical orientation and one in a horizontal orientation. Each switch 82, 84 includes a first pair of switch contacts 86 and a second pair of switch contacts 88 between which a bubble of electrically conductive mercury 90 is constrained for movement. Gravity acts on the electrically conductive mercury 90 in such a way as to close one of the two switch contacts 86 or 88 of one of the two orientation sensors 82 or 84, while both switch contacts 86 and 88 of the other orientation sensor 82 or 84 are open. In this manner, three switches are always open so that the signals are at the +V (high) level, while one switch is closed so that signal is at the low (ground) level. By knowing which signal is low, the camera orientation is determined. For example, if switch contacts 88 of switch 82 are closed, the camera 10 is being held in a horizontal position. If one of the switch contacts 86 or 88 of switch 84 are closed, then the camera 10 is being held in one of the two portrait positions, and so on. The switch outputs are provided to the logic section 40, which converts the switch signals into orientation codes, e.g., 00 = horizontal, 01 = vertical (clockwise), and 10 = vertical (counterclockwise).

[0025] Figure 7 represents a concept for an orientation sensor. In fact, it is preferable not to use mercury at least in some applications. Another possibility includes a photointerruptor type of switch in which, for example, a light-blocking ball is entrained to move along a track, depending on camera orientation, with photoemitters and detectors at either end thereof for sensing orientation in the respective portrait positions. Alternatively, for example, a weighted light-blocking wheel can be mounted to rotate between a photoemitter and two detectors fixed to the camera body. Light-transmitting slots are arranged in the wheel such that both detectors are blocked in the landscape position and a different one of the detectors is blocked in each portrait position.

[0026] The operation of the camera is shown in Figure 3. When the user takes the image by pressing the shutter button 44, the sensor 16 is exposed and read out while the orientation of the camera 10 is determined by the orientation determination section 36 as the image is read out from the sensor 16. Where correction is required, the image processor 22 rotates the image data, and the image data is stored in the memory card 26, in proper orientation (as shown in Figure 4). An alternative operational embodiment is shown in Figures 5 and 6, in which the orientation code is stored along with each image in a header as the image data is written into the RAM memory 52. At this stage, each image remains 512 (V) x 768(H), and the orientation codes indicate whether the image should be displayed in the normal landscape mode (00), or rotated clockwise when displayed, since it was taken using portrait orientation #1 (01), or rotated counterclockwise when displayed, since it was taken using portrait orientation #2 (10). As each image is read out from RAM 52, the processor 57 checks the orientation code and rotates the image, if necessary, depending on the camera orientation. Each image is thus stored in the memory card 24 in its proper orientation, as shown in Figure 6. An advantage of the alternative embodiment is that several images, with their headers, can be captured and stored in the buffer memory 52 before the processor 57 commences image rotation. This capability facilitates a burst mode of operation, in which several images are quickly taken. Additionally, the aforementioned U.S. Patent No. 5,270,831, which is incorporated herein by reference, discloses a suitable signal processing architecture for use in a processor to decode orientation information in the image header in the course of processing the captured image, so that the image will be stored in the memory card in an upright orientation and at the correct aspect ratio for subsequent display by a computer.

[0027] As also shown in Figure 6, the orientation code may be stored along with the properly oriented images in the memory card 26. The stored orientation code may be useful when the memory card 26 is transferred to the computer 28, and the computer 28 performs image processing on the image. For instance, image processing for exposure control may be made sensitive to image orientation, or the codes may allow reorienting the aspect ratio of the image to obtain a portrait-like effect with, e.g., border areas.

[0028] Alternatively, the camera may have an orientation on/off switch 36' to permit the camera to store uncorrected images on the memory card. Orientation correction would then be performed solely by the computer. If, however, it is desirable that all images be corrected within the camera, the switch 36' would be set to on and the camera operation flow shown in Figure 3 would be used. In this embodiment, images are always rotated, if

necessary, and the record of the original orientation is not saved in a header (except for the alternative embodiment discussed above).

[0029] The invention has been described with reference to a preferred embodiment. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention as defined in the claims.

Claims

1. An electronic still photographic system (10) which can be positioned in a variety of orientations relative to a subject, including a normal horizontal "landscape" orientation and first and second vertical "portrait" orientations, one for clockwise rotation and the other for counterclockwise rotation, said system comprising:

   a) a photographic camera having:

   an electronic image sensor (16) having a two-dimensional array of rows and columns of photosites for generating a digital image signal corresponding to a still image of the subject;
   an orientation determination section (36), generating an orientation signal, for sensing the orientation of the camera relative to the subject and positively distinguishing a first clockwise and a second counterclockwise vertical orientation from the horizontal orientation; and
   an image processor (22) responsive to the orientation signal for processing the digital image signal and correcting the orientation thereof so that the still image is output from the image processor in a predetermined orientation, whereby the number of rows of image data stored for pictures taken in the vertical orientation is different from the number of rows of image data stored for pictures taken in the horizontal orientation; and

   b) a removable digital memory susceptible to being connected to the photographic camera for storing the digital image signal provided by the image processor in the predetermined orientation, whereby, during subsequent access by a display device, processed still images taken in the vertical orientations present the same orientation as the processed images taken in the horizontal orientation.

2. A photographic system as claimed in claim 1 wherein the rows and columns of photosites differ in number, the number of columns output for vertical orientations is substantially equal to the number of rows output for horizontal orientations, and the number of rows output for vertical orientations is substantially equal to the number of columns output for horizontal orientations.

3. A photographic system as claimed in claim 1 or 2 wherein the removable memory is a removable memory card

4. A photographic system as claimed in any one of claims 1 to 3 wherein the orientation determination section (36) positively distinguishes the normal horizontal "landscape" orientation from the inverted horizontal orientation

5. A photographic system as claimed in any one of claims 1 to 4 wherein the orientation sensor includes at least one mercury switch.

6. A photographic system as claimed in any one of claims 1 to 4 wherein the orientation sensor includes at least one optical switch.

7. A photographic system as claimed in any one of claims 1 to 6 wherein the orientation determination section includes a logic section (42) for producing an orientation code having several values indicative of the vertical and horizontal orientations.

8. A photographic system as claimed in any one of claims 1 to 7 wherein the image processor includes a buffer memory for storing the image signal and a memory controller for addressing the buffer memory whereby the addresses are varied between read and write cycles such that the memory is read in a different order than it is written for each vertical orientation and the image is always output from the image processor in the predetermined orientation.

9. A method operative within a photographic system having a hand-held photographic camera and a removable digital memory susceptible to be connected to said camera, for rotating images captured by the camera in a variety of orientations, including a horizontal "landscape" orientation, and first and second vertical "portrait" orientations, one for clockwise rotation and the other for counterclockwise rotation, said method comprising the steps of:

   a) sensing the orientation of the camera relative to a subject;
   b) positively distinguishing a first clockwise vertical orientation and a second counterclockwise vertical orientation from the horizontal orientation;

c) generating an image signal corresponding to a still image of the subject from an image sensor having a two-dimensional array of rows and columns of photosites;
d) processing the image signal in response to the orientation in order to rotate the image by 90 degrees counterclockwise in the first vertical orientation and 90 degrees clockwise in the second vertical orientation to correct the first and second vertical orientations thereof, and provide a processed image signal that is output in a predetermined orientation, whereby the number of rows of image data stored for pictures taken in the vertical orientation is different from the number of rows of image data stored for pictures taken in the horizontal orientation; and
e) storing the image signal in said removable digital memory for subsequent access by a display device, whereby the still image will always be displayed in the predetermined orientation.

10. A method as claimed in claim 9 wherein the rows and columns of photosites differ in number, the number of columns output for vertical orientations is substantially equal to the number of rows output for horizontal orientations, and the number of rows output for vertical orientations is substantially equal to the number of columns output for horizontal orientations.

Patentansprüche

1. Elektronisches Stehbildsystem (10), das in verschiedenen Ausrichtungen relativ zu einem Aufnahmegegenstand positionierbar ist, mit einer normalen, horizontalen "Landschafts"-Ausrichtung und einer ersten und zweiten vertikalen "Portrait"-Ausrichtung, wobei eine für die Drehung im Uhrzeigersinn und die andere für eine Drehung im Gegenuhrzeigersinn vorgesehen ist, und wobei das System folgende Komponenten umfasst:

a) eine fotografische Kamera mit

- einem elektronischen Bildsensor (16) mit einer zweidimensionalen Anordnung aus Zeilen und Spalten von Fotoelementen, welche ein einem Stehbild des Aufnahmegegenstands entsprechendes digitales Bildsignal erzeugen;
- einem ein Ausrichtungssignal erzeugenden Ausrichtungsbestimmungsteil (36), welches die Ausrichtung der Kamera relativ zum Aufnahmegegenstand erfasst und automatisch zwischen einer ersten, um Uhrzeigensinn erfolgenden und einer zweiten, im Gegenuhrzeigersinn erfolgenden Vertikal-Ausrichtung gegenüber der horizontalen Ausrichtung unterscheidet; und
- einem auf das Ausrichtungssignal ansprechenden Bildprozessor (22) zum Verarbeiten des digitalen Bildsignals und Korrigieren der Ausrichtung, so dass das Stehbild aus dem Bildprozessor in einer vorbestimmten Ausrichtung ausgegeben wird, wobei sich die Anzahl der Zeilen von Bilddaten, die für in der vertikalen Ausrichtung aufgenommene Bilder gespeichert wurden, von der Anzahl der Zeilen von Bilddaten, die für in der horizontalen Ausrichtung aufgenommene Bilder gespeichert wurden, unterscheidet; und

b) einen entfernbaren Digitalspeicher, der mit der fotografischen Kamera zum Speichern des vom Bildprozessor in der vorbestimmten Ausrichtung erzeugten digitalen Bildsignals verbindbar ist, wobei beim späteren Zugriff durch eine Anzeigeeinrichtung verarbeitete Stehbilder, die in der vertikalen Ausrichtung aufgenommen wurden, die gleiche Ausrichtung zeigen wie die verarbeiteten Bilder, die in horizontaler Ausrichtung aufgenommen wurden.

2. Fotografisches System nach Anspruch 1, dadurch gekennzeichnet, dass die Zeilen und Spalten von Fotoelementen sich in ihrer Anzahl unterscheiden, wobei die für vertikale Ausrichtungen ausgegebene Anzahl von Spalten im wesentlichen der für horizontale Ausrichtungen ausgegebenen Anzahl von Zeilen entspricht, und die für vertikale Ausrichtungen ausgegebene Anzahl von Zeilen im wesentlichen der für horizontale Ausrichtungen ausgegebenen Anzahl von Spalten entspricht.

3. Fotografisches System nach Anspruch 1 oder 2, dadurch gekennzeichnet, dass der entfernbare Speicher eine entnehmbare Speicherkarte ist.

4. Fotografisches System nach einem der Ansprüche 1 - 3, dadurch gekennzeichnet, dass der Ausrichtungsbestimmungsteil (36) die normale horizontale "Landschafts"-Ausrichtung von der umgekehrten horizontalen Ausrichtung automatisch unterscheidet.

5. Fotografisches System nach einem der Ansprüche 1 - 4, dadurch gekennzeichnet, dass der Ausrichtungssensor mindestens einen Quecksilberschalter aufweist.

6. Fotografisches System nach einem der Ansprüche 1 - 4, dadurch gekennzeichnet, dass der Ausrich-

tungssensor mindestens einen optischen Schalter aufweist.

7. Fotografisches System nach einem der Ansprüche 1 - 6, dadurch gekennzeichnet, dass der Ausrichtungsbestimmungsteil einen Logikteil (42) zum Erzeugen eines Ausrichtungscode aufweist, der mehrere Werte beinhaltet, welche die vertikale und horizontale Ausrichtung kennzeichnen.

8. Fotografisches System nach einem der Ansprüche 1 - 7, dadurch gekennzeichnet, dass der Bildprozessor einen Zwischenspeicher zum Speichern des Bildsignals und eine Speichersteuerung zum Adressieren des Zwischenspeichers aufweist, wobei die Adressen zwischen Lese- und Schreibzyklen wechseln, so dass der Speicher in einer anderen Reihenfolge gelesen wird als er für jede vertikale Ausrichtung beschrieben wird, und das Bild vom Bildprozessor immer in der vorbestimmten Ausrichtung ausgegeben wird.

9. Verfahren, einsetzbar in einem fotografischen System mit einer fotografischen Handkamera und einem entfernbaren, mit der Kamera verbindbaren Digitalspeicher zum Drehen von in verschiedenen Ausrichtungen aufgenommenen Bildern, und mit einer normalen, horizontalen "Landschafts"-Ausrichtung und einer ersten und zweiten vertikalen "Portrait"-Ausrichtung, wobei eine für die Drehung im Uhrzeigersinn und die andere für eine Drehung im Gegenuhrzeigersinn vorgesehen ist, und wobei das Verfahren folgende Schritte umfasst:

a) Erfassen der Ausrichtung der Kamera relativ zu einem Aufnahmegegenstand;
b) automatisches Unterscheiden einer ersten Vertikal-Ausrichtung im Uhrzeigersinn und einer zweiten Vertikal-Ausrichtung im Gegenuhrzeigersinn gegenüber der Horizontal-Ausrichtung;
c) Erzeugen eines einem Stehbild des Aufnahmegegenstands entsprechenden Bildsignals durch einen Bildsensor, der eine zweidimensionale Anordnung aus Zeilen und Spalten von Fotoelementen aufweist;
d) Verarbeiten des Bildsignals in Abhängigkeit von der Ausrichtung, um das Bild um 90° im Gegenuhrzeigersinn in der ersten Vertikal-Ausrichtung und um 90° im Uhrzeigersinn in der zweiten Vertikal-Ausrichtung zu drehen, so dass die erste und zweite Vertikal-Ausrichtung korrigiert werden kann, und ein verarbeitetes Bildsignal zu erzeugen, das in einer vorbestimmten Ausrichtung ausgegeben wird, wobei sich die Anzahl der Zeilen von Bilddaten, die für in der vertikalen Ausrichtung aufgenommene Bilder gespeichert wurden, von der Anzahl der Zeilen von Bilddaten, die für in der horizontalen Ausrichtung aufgenommene Bilder gespeichert wurden, unterscheidet; und
e) Speichern des Bildsignals im entfernbaren Digitalspeicher für den späteren Zugriff durch eine Anzeigevorrichtung, wobei das Stehbild immer in der vorbestimmten Ausrichtung wiedergegeben wird.

10. Verfahren nach Anspruch 9, dadurch gekennzeichnet, dass die Zeilen und Spalten von Fotoelementen sich in ihrer Anzahl unterscheiden, wobei die für vertikale Ausrichtungen ausgegebene Anzahl von Spalten im wesentlichen der für horizontale Ausrichtungen ausgegebenen Anzahl von Zeilen entspricht, und die für vertikale Ausrichtungen ausgegebene Anzahl von Zeilen im wesentlichen der für horizontale Ausrichtungen ausgegebenen Anzahl von Spalten entspricht.

Revendications

1. Système photographique fixe électronique (10) qui peut être positionné selon une diversité d'orientations par rapport à un sujet, incluant une orientation horizontale normale "paysage" et des première et deuxième orientations verticales "portraits", une pour rotation dans le dans le sens des aiguilles d'une montre et l'autre pour rotation dans le sens inverse des aiguilles d'une montre, ledit système comprenant :

a) un appareil photographique comportant :

un capteur d'image électronique (16) présentant une matrice à deux dimensions de rangées et colonnes de photosites pour générer un signal d'image numérique correspondant à une image fixe du sujet ;
une section de détermination d'orientation (36), générant un signal d'orientation, pour détecter l'orientation de l'appareil photographique par rapport au sujet et distinguer positivement une première orientation verticale dans laquelle lappareil a été basculé dans le sens des aiguilles d'une montre, et une deuxième orientation verticale dans laquelle l'appareil a été basculé dans le sens inverse des aiguilles d'une montre à partir de l'orientation horizontale ; et
un processeur d'image (22) sensible au signal d'orientation pour traiter le signal d'image numérique et corriger l'orientation de celui-ci de sorte que l'image fixe soit délivrée en sortie à partir du processeur d'image selon une orientation prédéterminée, d'où il résulte que le nombre de ran-

gées de données image mémorisées pour les images prises selon l'orientation verticale est différent du nombre de rangées de données image mémorisées pour les images prises selon l'orientation horizontale ; et

b) une mémoire numérique amovible susceptible d'être connectée à l'appareil photographique pour mémoriser le signal d'image numérique délivré par le processeur d'image selon l'orientation prédéterminée, d'où il résulte que, durant l'accès consécutif par un dispositif d'affichage, les images fixes traitées prises selon les orientations verticales présentent la même orientation que les images traitées prises selon l'orientation horizontale.

2. Système photographique selon la revendication 1, dans lequel les rangées et colonnes de photosites différent en nombre, le nombre de colonnes délivrées pour les orientations verticales est essentiellement égal au nombre de rangées délivrées en sortie pour les orientations horizontales, et le nombre de rangées délivrées pour les orientations verticales est essentiellement égal au nombre de colonnes délivrées pour les orientations horizontales.

3. Système photographique selon la revendication 1 ou la revendication 2, dans lequel la mémoire amovible est une carte de mémoire amovible.

4. Système photographique selon l'une quelconque des revendications 1 à 3, dans lequel la section de détermination d'orientation (36) distingue positivement l'orientation horizontale normale "paysage" de l'orientation horizontale inversée.

5. Système photographique selon l'une quelconque des revendications 1 à 4, dans lequel le capteur d'orientation inclut au moins un interrupteur à mercure.

6. Système photographique selon l'une quelconque des revendications 1 à 4, dans lequel le capteur d'orientation inclut au moins un interrupteur optique.

7. Système photographique selon l'une quelconque des revendications 1 à 6, dans lequel la section de détermination d'orientation inclut une section logique (42) pour produire un code d'orientation présentant plusieurs valeurs indicatives des orientations verticale et horizontale.

8. Système photographique selon l'une quelconque des revendications 1 à 7, dans lequel le processeur d'image inclut une mémoire tampon pour mémoriser le signal d'image et un contrôleur de mémoire pour adresser la mémoire tampon, d'où il résulte que les adresses varient entre cycles de lecture et d'écriture d'une manière telle que la mémoire est lue dans un ordre différent de celui dans lequel elle est écrite pour chaque orientation verticale et l'image est toujours délivrée en sortie à partir du processeur d'image selon l'orientation prédéterminée.

9. Procédé fonctionnant à l'intérieur d'un système photographique comportant un appareil photographique portable et une mémoire numérique amovible susceptible d'être connectée audit appareil photographique, pour faire pivoter les images acquises par l'appareil photographique selon une diversité d'orientations, incluant une orientation horizontale "paysage", et des première et deuxième orientations verticales "portrait", une pour rotation dans le dans le sens des aiguilles d'une montre et l'autre pour rotation dans le sens inverse des aiguilles d'une montre, ledit procédé comprenant les étapes consistant à

a) détecter l'orientation de l'appareil photographique par rapport à un sujet ;
b) distinguer positivement une première orientation verticale dans laquelle l'appareil a été basculé dans le sens des aiguilles d'une montre et d'une deuxième orientation verticale dans laquelle l'appareil a été basculé dans le sens inverse des aiguilles d'une montre à partir de l'orientation horizontale ;
c) générer un signal d'image correspondant à une image fixe du sujet à partir d'un capteur d'image comportant une matrice à deux dimensions de rangées et colonnes de photosites ;
d) traiter le signal d'image en réponse à l'orientation afin de faire pivoter l'image de 90 degrés dans le sens des aiguilles d'une montre dans la première orientation verticale et de 90 degrés dans le dans le sens inverse des aiguilles d'une montre dans la deuxième orientation verticale pour corriger les première et deuxième orientations verticales de celle-ci, et délivrer un signal d'image traité qui est délivré en sortie selon une orientation prédéterminée, d'où il résulte que le nombre de rangées de données image mémorisées pour des images prises selon l'orientation verticale est différent du nombre de rangées de données image mémorisées pour les images prises selon l'orientation horizontale ; et
e) mémoriser le signal d'image numérique dans ladite mémoire numérique amovible pour l'accès ultérieur par un dispositif d'affichage, d'où il résulte que l'image fixe sera toujours affichée selon l'orientation prédéterminée.

10. Procédé selon la revendication 9, dans lequel les rangées et colonnes de photosites diffèrent en nombre, le nombre de colonnes délivrées en sortie pour les orientations verticales est essentiellement égal au nombre de rangées délivrées en sortie pour des orientations horizontales, et le nombre de rangées délivrées en sortie pour des orientations verticales est essentiellement égal au nombre de colonnes délivrées en sortie pour des orientations horizontales.

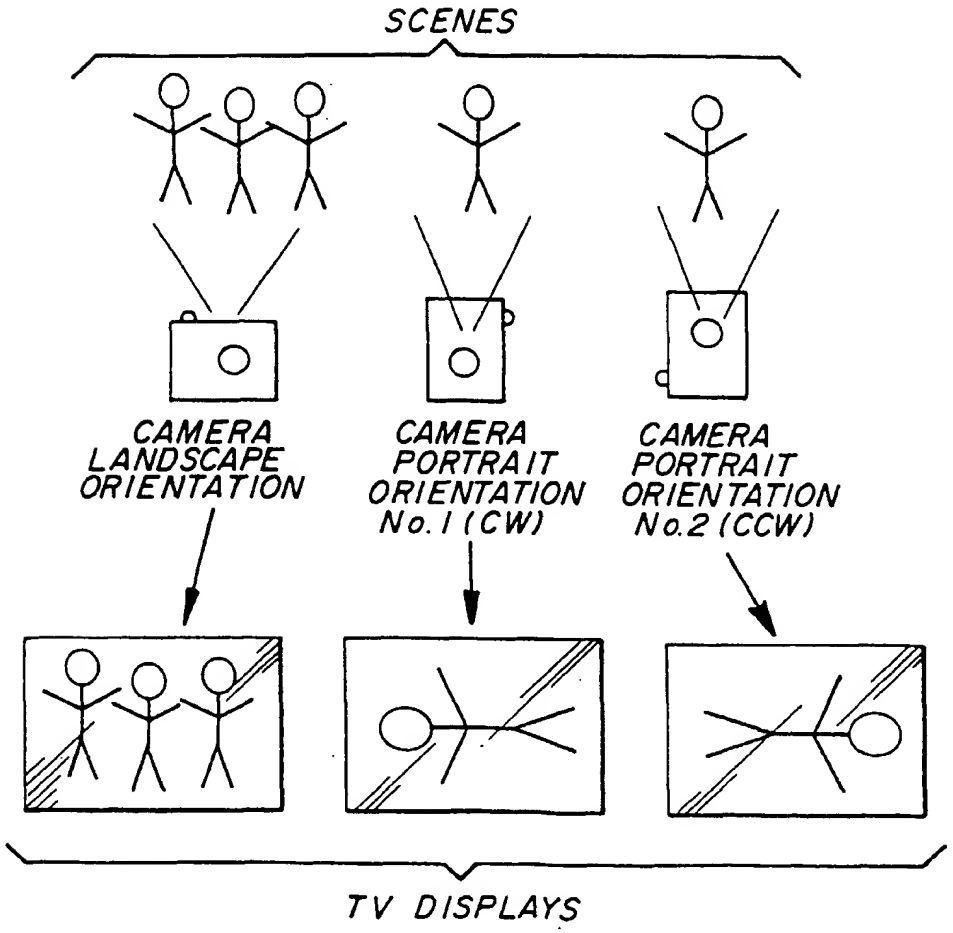


Fig. 1

PRIOR ART

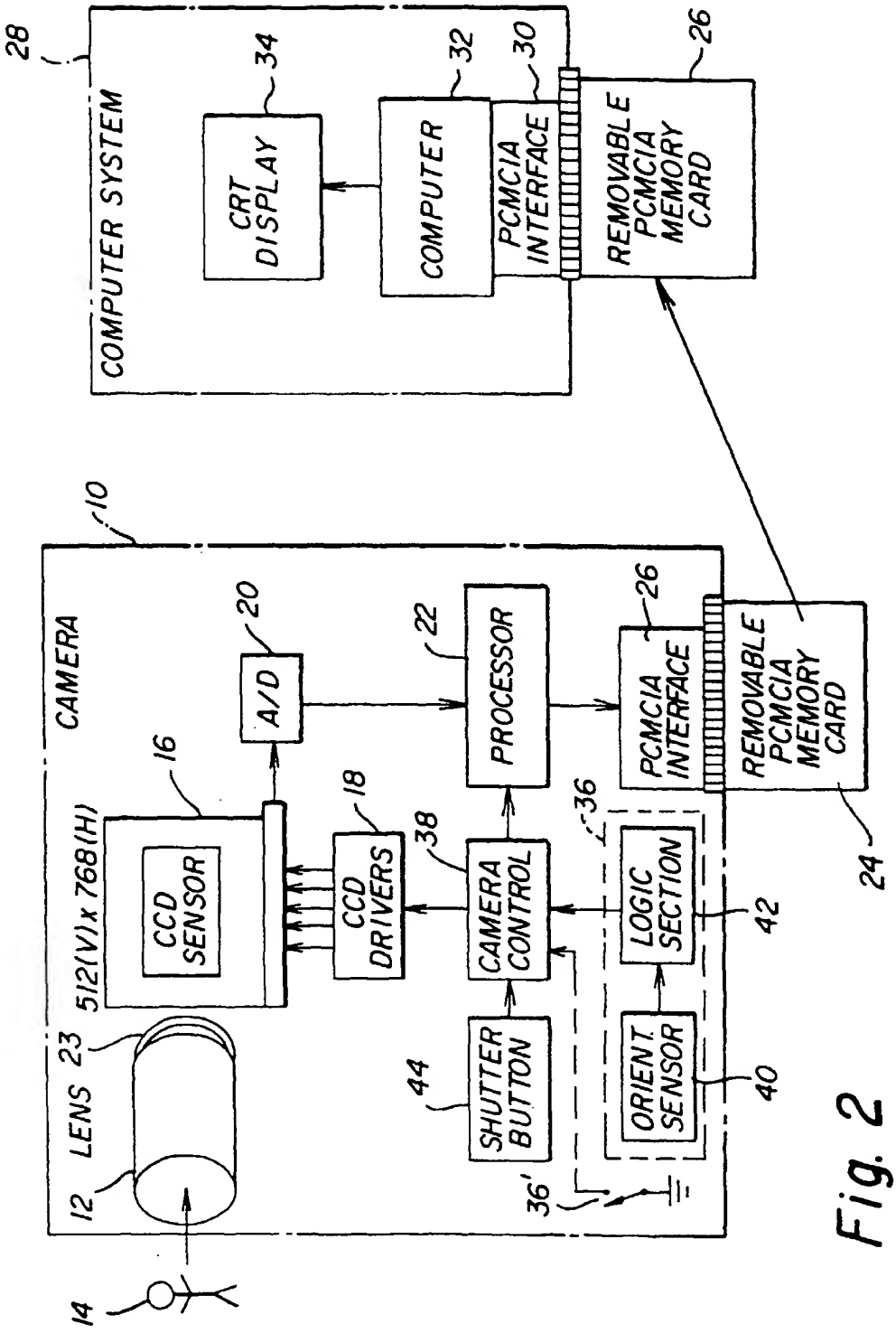
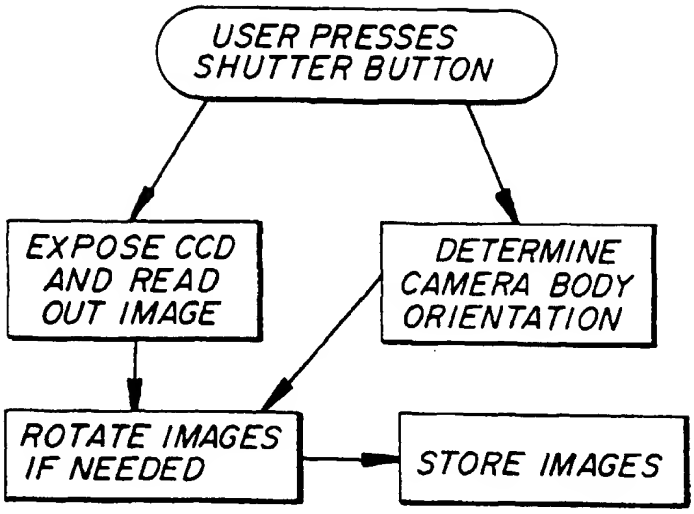

28
COMPUTER SYSTEM
CRT DISPLAY
34
COMPUTER
32
PCMCIA INTERFACE
30
REMOVABLE PCMCIA MEMORY CARD
26
10
CAMERA
A/D
20
PROCESSOR
22
PCMCIA INTERFACE
26
REMOVABLE PCMCIA MEMORY CARD
24
16
512(V) x 768(H)
CCD SENSOR
18
CCD DRIVERS
38
CAMERA CONTROL
36
LOGIC SECTION
42
ORIENT. SENSOR
40
SHUTTER BUTTON
44
36'
LENS
23
12
14

Fig. 2

Fig. 3


USER PRESSES SHUTTER BUTTON
EXPOSE CCD AND READ OUT IMAGE
DETERMINE CAMERA BODY ORIENTATION
ROTATE IMAGES IF NEEDED
STORE IMAGES

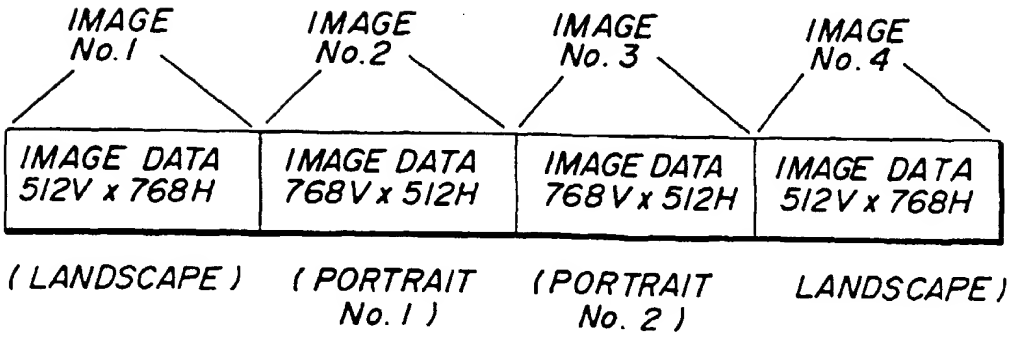
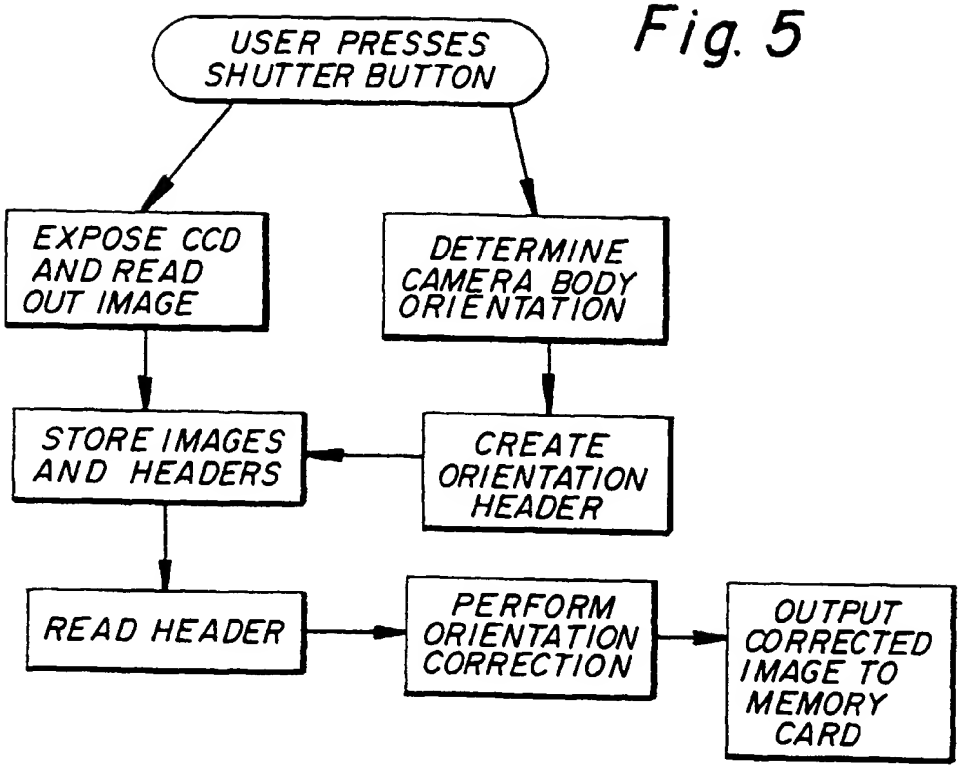


IMAGE No.1
IMAGE No.2
IMAGE No.3
IMAGE No.4
IMAGE DATA 512V x 768H
IMAGE DATA 768V x 512H
IMAGE DATA 768V x 512H
IMAGE DATA 512V x 768H
(LANDSCAPE)
(PORTRAIT No.1)
(PORTRAIT No.2)
LANDSCAPE)

Fig. 4

Fig. 5


USER PRESSES SHUTTER BUTTON
EXPOSE CCD AND READ OUT IMAGE
DETERMINE CAMERA BODY ORIENTATION
STORE IMAGES AND HEADERS
CREATE ORIENTATION HEADER
READ HEADER
PERFORM ORIENTATION CORRECTION
OUTPUT CORRECTED IMAGE TO MEMORY CARD

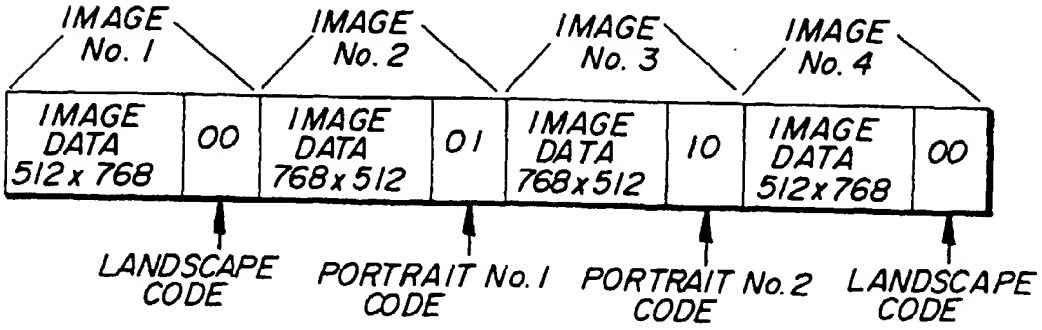


IMAGE No. 1
IMAGE No. 2
IMAGE No. 3
IMAGE No. 4
IMAGE DATA 512 x 768
00
IMAGE DATA 768 x 512
01
IMAGE DATA 768 x 512
10
IMAGE DATA 512 x 768
00
LANDSCAPE CODE
PORTRAIT No. 1 CODE
PORTRAIT No. 2 CODE
LANDSCAPE CODE

Fig. 6

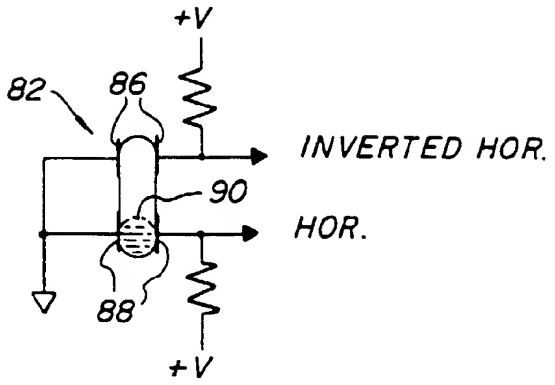
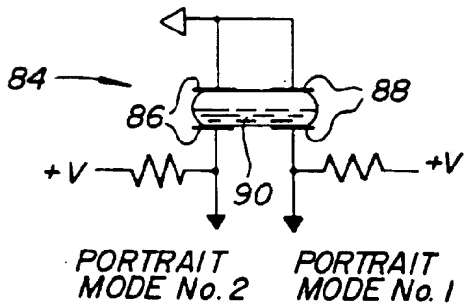

+V
82
86
INVERTED HOR.
90
HOR.
88
+V

Fig. 7


84
88
86
+V
+V
90
PORTRAIT MODE No. 2
PORTRAIT MODE No. 1

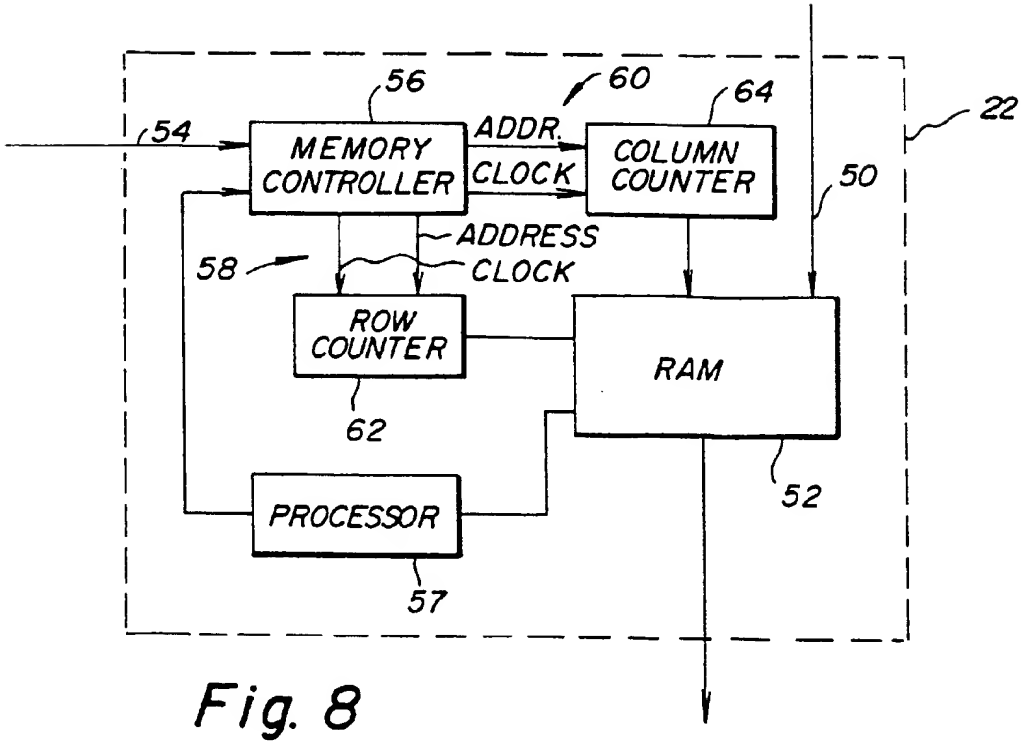

56
60
64
22
54
MEMORY CONTROLLER
ADDR.
CLOCK
COLUMN COUNTER
50
ADDRESS
58
CLOCK
ROW COUNTER
RAM
62
52
PROCESSOR
57

Fig. 8

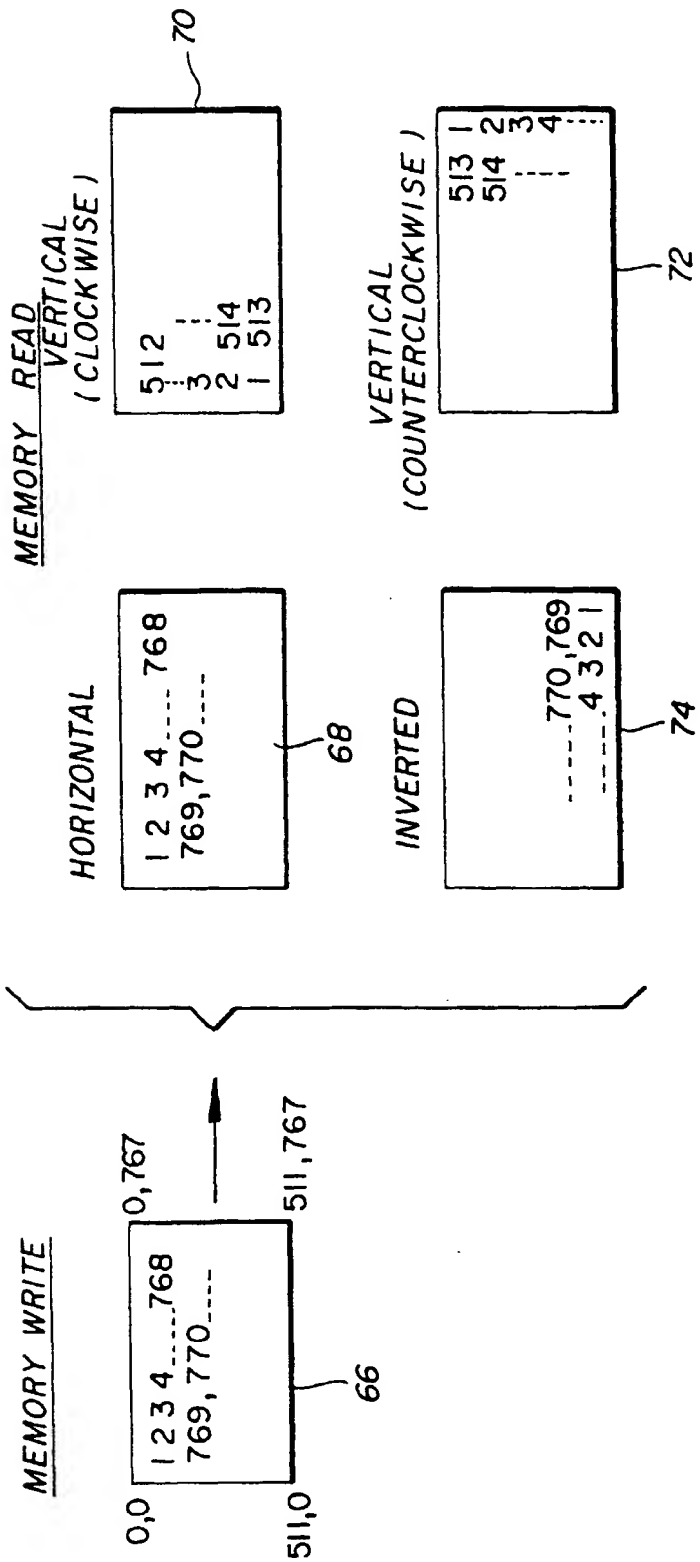

MEMORY WRITE
0,0
511,0
0,767
511,767
1 2 3 4 ---- 768
769, 770 ----
66
MEMORY READ
HORIZONTAL
1 2 3 4 ---- 768
769, 770 ----
68
VERTICAL
(CLOCKWISE)
512
3
2 514
1 513
70
INVERTED
770, 769
4 3 2 1
74
VERTICAL
(COUNTERCLOCKWISE)
513 1
514 2
3
4
72

Fig. 9